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Companies struggle to automate houses (home automation business spurred by national project). (Includes related article on the Smart House project.)
Brody, Herb
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March, 1988

TEXT:

Companies Struggle To Automate Homes

For years, optimists have been predicting huge markets for systems that turn the home into an obedient and intelligent servant, equipped to ward off burglars, switch on appliances, and adjust the thermostat. But as often happens with innovative technologies, big companies are waiting on the sidelines while the little guys test the market. The contestants in this embryonic business, however, have sustained themselves more on hope than on actual sales.

Depending on how it is defined, the home-automation market in 1987 totaled between \$50 million and \$350 million. "The market is a gleam in our eye," says Harry Krall of Cardinal Technologies, an RCA spin-off that this year will begin to sell computer products such as modems and printers designed for the automated home.

Analysts predict that by the mid-1990s, billions of dollars a year will go toward converting ordinary residences into "smart" houses. In 1995, 4 percent of all new homes will come with a central computer-control system, predicts market-watcher Patricia Parks of Parks Associates. During the next five years, that will shoot to 10 percent.

Home automation appeals mainly to buyers of houses that cost \$250,000 or more. Robert Russ, chairman of startup Unity Systems, defines the target as the top 5 to 10 percent of new houses and the top 5 percent of existing ones. That comes to 50,000 to 100,000 homes per year, says Russ.

Many observers find it hard to conceal their frustration with the sluggish growth of the home-automation business. "The industry is taking longer to pick up than anticipated," says Roger B. Dooley, publisher of Electronic House magazine. "A few years ago, the explosion was predicted to be right around the corner. It still hasn't happened."

Even though the real race has yet to begin, the contestants are battling furiously for position. Events on several fronts warrant close watching:

- * A clique of scrappy entrepreneurial companies is offering commercial home-automation systems. New entries are spicing up the field, and venture capitalists are starting to take notice.

- * Big companies are preparing to dive into the fray.

- * The National Association of Home Builders is orchestrating a multi-industry consortium that aims to radically alter the way homes are built, making automation as integral a part of the building as electricity and plumbing. A variety of companies--mainly manufacturers of such prosaic items as electrical cable and connectors--are joining the consortium in hopes of gaining the competitive edge when smart houses come on the market, possibly in the next two to three years.

- * The Electronic Industries Association intends to publish a standard language that will let home appliances communicate with one another.

The biggest obstacle facing companies in this nascent industry is how to convince consumers that an automated home is worth the money. The situation is reminiscent of that of personal computers in the late 1970s; available products appeal mainly to electronics hobbyists. "When we entered this business in 1982, we got a lot of blank stares," says Marty Burns, president of Hypertek. The main benefit of home automation, says Burns, is "a sense of well-being. That's not always easy to understand."

A relative newcomer to the business expresses similar frustration. "The problem is that there is no single feature that justifies a home-automation system," says Russell Evans, president of Archinetics, a small company that is challenging Unity and Hypertek for an early share of the market.

Indeed, today's home-automation systems offer benefits from the

clearly useful to the frivolous. The basic idea is to make a house run itself, with minimal human intervention. Before retiring for the night, for example, people might go through a ritual such as turning certain lights on and off, making sure appliances are off, arming a security system, turning down the thermostat, and running the dishwasher so that it uses less expensive off-peak electricity.

Automating these tasks requires little new technology. Devices that have been on the market for several years, such as power-line carrier modules from X-10 USA Inc., can perform most rudimentary home-control functions. X-10's modules operate lights, appliances, and heating systems according to a programmed schedule. On/off instructions flow through a house's existing wiring. You could thus order the porch light to turn on before you arrive home from work, and the thermostat to set back every night, all through one central console.

It's also possible to link a home-control system to a burglar alarm. In addition to triggering a siren, an intrusion might make all the lights flash on and off in unison, helping identify the invaded house to police.

X-10 USA sells these systems both directly and under the Sears and Radio Shack labels. Business is booming--1987 sales were triple those of 1986, according to president Peter Lesser. From 1985 to 1986, sales shot up 30 percent, and another 53 percent in 1987.

The module costs about \$10 and needs no additional wiring. However, it passes signals only in one direction, from the central console to the lights and appliances. Far more sophisticated automation will come from systems that can pass messages back and forth and from point to point.

The company most closely identified with home-control equipment, Honeywell, is marketing dozens of individual gadgets but no system to link them together. Although obviously interested in home automation, Honeywell has chosen not to take the lead in what is known as whole-house systems. "People don't want an automated home," says Richard Giddings, Honeywell's manager of home and building automation research. "They want a home that's comfortable to live in. There must be enough of a benefit to put up with the hassle."

The first major corporate entry into the home-automation filed will come from Japan: Mitsubishi Electric has announced plans to start marketing a system later this year. The company has sold a home-automation system domestically for several years. However, because Japanese and U.S. lifestyles are so different, Mitsubishi enlisted a U.S. company, CyberLynx, to design the system that will be sold here. CyberLynx has offered a home-control system called SmartHome for several years, with limited success.

The Mitsubishi system, which will be sold through its MEDAMA subsidiary, resembles those from Unity and Archinetics. Like its competitors, Mitsubishi is aiming for the high-end home buyer; installed systems will cost \$10,000 to \$20,000. Medama is testing the system in selected homes and will start production by mid-year, according to Dany Ray, director of market development.

These plans have generated some skepticism. Market analyst Parks predicts that there will not be enough demand to make the Mitsubishi system profitable. Other observers point out that the Japanese giant has previously announced U.S. marketing plans that have failed to materialize.

But if Mitsubishi delivers, the ramifications would be significant. By publications its product, the company would promote the concept of home automation in general. Indeed, competitor Archinetics is "waiting anxiously for Mitsubishi" to come in, says Gail George, whose official title is product evangelist. "We'll all benefit from Mitsubishi's advertising."

This sounds eerily familiar to those who have followed the business. In 1985, virtually identical hopes were pinned on General Electric, which introduced an inexpensive system called Homeminder. But GE never promoted the product as heavily as it promised to and, after two years of meager sales, yanked Homeminder from the market.

Home-automation companies are aiming their systems primarily at new construction, for two reasons. First, the logical time to equip a home for automation is before it's finished; stringing wire is much easier and cheaper before walls and ceilings go up. Second, the cost of an automation system inflicts less pain when it can be paid over a 20- or 30-year mortgage. A \$10,000 system might add \$100 to the monthly payment, a

tolerable burden for someone buying a \$200,000 house.

But inside the new-construction market lurks a potentially formidable adversary for home-automation companies--the National Association of Home Builders (NAHB). For the past three years, this organization has been pushing an ambitious and increasingly controversial project called Smart House. If the project succeeds, it will compete directly with the fledgling home-automation business. It also could bring diverse companies into the arena, from cable manufacturers to toaster makers.

The NAHB exists to promote the construction and sale of new houses. The Smart House project is, in essence, an elaborate scheme to give the home buyer a reason to prefer a newly built house over an old one. The group is pursuing its goal with an unusual business strategy--it has set up a wholly owned subsidiary, the Smart House Development Venture, to promote the concept. The venture developed a radical new method of wiring homes that not only eases automation but also greatly lessens the chance of electrically caused fires or injuries (see "How the Smart House Would Work," above). The project cleared a significant hurdle last year when the National Electrical Code was revised to permit the new type of wiring.

The NAHB has also created a multiple-industry consortium. To join, companies pay a one-time fee and agree to help develop products to take advantage of Smart House's unique features. In return, the NAHB licenses the companies to use a proprietary integrated-circuit chip that will make their products compatible with all others in the Smart House. The price of entry has escalated, from as low as \$10,000 when the project started in 1985 to about \$100,000, according to Smart House spokesman Ken Geremia.

To begin with, the NAHB will license three companies per product category. This tri-opoly will last for the first four years that Smart Houses are on the market. The NAHB is pitching the deal to companies by implying that the train is boarding; once it starts rolling, non-participants will be left at the station as the train chugs off into the promised land of home-automation profits.

So far, 41 companies have signed contracts to make pieces of the Smart House. Most produce what the NAHB calls the "core"--the cable, outlets, connectors, and so forth that will hide behind the walls and make the whole system work. "Ninety percent of the dollar value of the core products is now signed up," says Keith Phillips, the venture's marketing vice president. The NAHB has had to fend off applicants for certain products, particularly the "power block"--the computer-controlled wall socket that Phillips calls the most revolutionary item in the Smart House.

With this infrastructure in place, the venture is trying harder to sign up appliance makers. Manufacturers of heating, ventilation, and air-conditioning equipment have filled up their product categories. Next, the venture is focusing on less fundamental items such as refrigerators and washing machines. Whirlpool has reached advanced stages of negotiation, and will probably be the first major appliance-maker to join the Smart House team.

Once these advanced dwellings begin to pop up around the country, the exclusive club of Smart House product makers will be sitting pretty. But many observers doubt the project's viability. They cite the system's radical nature, which requires major changes in wiring techniques used for most of the century. "Face it; you can't even get companies to make metric nuts," says Everett Sharey, manager of the construction products and services unit at consulting firm Arthur D. Little. Worse, the venture has been unable to attract a single consumer-electronics company. This failure alone might doom the Smart House. "People will pay for entertainment before they'll pay for convenience or security," says Sharey.

Smart House executives concede that the venture is risky. "It's a big poker game," says vice president Phillips. "Appliance makers don't want to invest in Smart House product development until they're convinced that these houses are really going to be built. But they don't want to get left behind, either."

The nature of the business deal has also come under attack. Unity Systems chairman Russ says that the short-lived period of exclusivity afforded Smart House manufacturers will make the system expensive. Makers of Smart House appliances, for example, will have to charge a premium during that limited period in order to recoup their product-development costs.

Most of all, the NAHB's secrecy rankles critics. Only fee-paying participants will enjoy access to the technology that governs exactly how signals will flow through the wiring, and many observers see this proprietary approach as a poor way to launch the home-automation industry. The business will only get going, they argue, when there is a publicly agreed-upon standard. Such openness would make the business seem far less risky to companies deciding whether to make products. "Manufacturers want to build to only one standard," says consultant Parks--and they prefer a standard without a hefty admission price.

Just such an open standard should arrive later this year from the Electronic Industries Association. The association's Consumer Electronics Bus committee has been laboring for years on the "CEBus," a detailed set of instructions on how to encode and transmit information within the home. Products compatible with the CEBus will hit the market in early 1989, predicts Thomas Mock, who heads CEBus work at the association.

The CEBus would permit interactive communications among a wide variety of household products. The standard has provisions for all existing transmission media: power-line carriers, coaxial cable, twisted-pair copper wire, infrared light, fiber optics, and radio waves. The bus could carry information from a personal computer to a printer, for example, or from a central VCR to televisions throughout the house. The dishwasher could alert the water heater to prepare a batch of extra-hot water before starting its cycle; at other times, water could be kept cooler, saving energy.

Some of the main benefits of the CEBus would go not to homeowners, but to the companies that service them. Smart appliances plugged into the bus could detect impending failure (a low freon level in a refrigerator or air conditioner, for instance) and automatically transmit its tale of woe to a repair center such as the one GE operates. Appliance makers tied into the home in this way might lower their repair costs, because their technicians would no longer spend time on trivial problems that users could fix themselves.

The CEBus would also make it easier for electric utilities to send signals to household appliances, perhaps shutting down nonessential loads during times of maximum power demand. By shaving peak consumption, a utility could spare itself the need to build an additional power plant.

The CEBus will not solve all communication problems. "Benefits do not accrue just because of communication," cautions Honeywell's Giddings. As an analogy, Giddings points out that the global telecommunications network makes it possible to call anywhere in the world--but little is gained if the two parties speak different languages.

Still, a communications standard is a necessary first step. Home-automation companies will start to "crawl out of the woodwork" once standards solidify, says market watcher Parks. Thus, the introduction of the CEBus may serve as the long-awaited impetus to get the home-automation business moving.

CAPTIONS: Views of the smart house venture. (table); Home automation: the early lineup. (table)

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1136756 H.W. WILSON RECORD NUMBER: BAST94005303

Need help? Call dial-a-machine

Berardinis, Larry;

Machine Design v. 65 (Nov. 26 '93) p. 32

DOCUMENT TYPE: Feature Article ISSN: 0024-9114 LANGUAGE: English

RECORD STATUS: New record

ABSTRACT: Minolta's latest copy machines feature built-in modems that automatically dial a local service center in the event of a problem. These machines can also diagnose their faults, allowing service centers to dispatch technicians with the replacement parts in hand. This new technology, called teleservicing, will mean less downtime, higher productivity, and tighter bonding with customers.

DESCRIPTORS: Copying machines--Maintenance and repair; Self testing;
Service industries;

?

01544683 H.W. WILSON RECORD NUMBER: BRGA89044683

Taking the headaches out of equipment maintenance.

AUGMENTED TITLE: third-party service providers; cover story

Graff, Gordon.

High Technology Business (High Technol Bus) v. 9 (Sept./Oct. '89) p. 18-21+

DOCUMENT TYPE: Feature Article

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LANGUAGE: English

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RECORD TYPE: Abstract RECORD STATUS: New record

ABSTRACT: Because computers and other high technology equipment can be so crucial to a business's operations, a variety of technologies and services aimed at minimizing downtime are being developed. Many businesses are relying on third-party services that will maintain and repair system components no matter who made or marketed them. This trend has prompted manufacturers like IBM to expand their maintenance coverage to equipment made by other manufacturers. Technological developments that are helping servicers maintain and repair high tech equipment include hand-held terminals capable of communicating with central computer databases for diagnostic information; built-in self monitoring devices, some of which can contact the machine's maintenance department when a fault is found; and expert systems that can help technicians diagnose problems. The next phase in high tech maintenance will be equipment with "electronic screwdriver" capabilities that can effect self repair.

DESCRIPTORS:

Computers--Maintenance and repair; Computer service industry

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BUICK XP2000 -- A CONCEPT CAR FOR THE 21ST CENTURY

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FLINT, Mich., Jan. 3 /PRNewswire/ -- Buick's XP2000, a concept car introduced for the 1995 auto show season, is an elegant mid-size sedan showcasing advanced technology to enhance the convenience, comfort and safety of its passengers.

XP2000 will be introduced in January (1995) at the North American International Auto Show in Detroit and at the Los Angeles Auto Show.

A vision of the cars Buick will offer as it enters the 21st Century -- and its own second century of providing premium American motorcars -- XP2000 is built around a revolutionary new generation of interactive electronics.

"XP2000 is more than a dream car -- we see it as a realistic preview of Buicks of the future," said Buick General Manager Edward H. Mertz.

"The exterior is a new example of the kind of exciting yet practical design that helps make today's Buicks -- for example the 1995 Riviera -- such a success with our customers," Mertz said. "And the advanced technology inside is designed to make daily driving easier and more enjoyable."

Michael J. O'Malley, Buick's general marketing manager, said Buick believes that what will increasingly set tomorrow's cars apart will be the way they enhance the lives of their owners.

"XP2000 is a dramatic way for us to explain how Buick plans to make every trip -- from a rush-hour commute to a long vacation with the kids -- as enjoyable and productive as possible," he said. "It reflects how Buick sees comfort and convenience evolving over the next several years. And it reflects traditional Buick characteristics -- substantial, distinctive, powerful and mature."

O'Malley said that "customers, especially those with families, are asking more and more for increased comfort, increased convenience and increased efficiencies in their products, services and their lives in general."

The heart of XP2000 is a network of advanced computers that tailors the car to the needs and desires of the individual driver and allows it to use the Intelligent Vehicle Highway Systems planned for the next century.

These computers also link XP2000 to the rapidly growing "information superhighway," making it easier for the driver to work and relax while in the car.

Among specific features:

- A remote keyless fob that can position the car's seats, climate controls and even driving response to a specific driver's tastes.

- A "Smart Card" setup in which a credit card may be inserted into the instrument panel, allowing the driver to automatically charge tolls, fuel, food and other services.

- An advanced "head-up" display, and an instrument-panel display that can be adapted for use with a personal computer.

- A navigation system that guides the driver along a map display.

- An array of safety features, ranging from eight air bags to a

detection system for obstacles near the path of the car.

The foundation for all of these features is a rear-wheel-drive vehicle with outstanding space efficiency.

Buick Chief Engineer Anthony H. Derhake said XP2000 achieves a major challenge to create a contemporary five-passenger mid-size sedan with an unusual amount of interior space as well as strong styling appeal.

"We wanted a car that would have great cabin and trunk space, as well as enough space under the hood to handle one of today's V-8 engines," Derhake said.

Michael E. Doble, Buick's manager of advanced concepts, pointed out that XP2000 is about the length of a mid-size Buick Regal, but with the interior space of Buick's flagship sedan, the Park Avenue. He described the exterior color as a pearlescent silver-gold.

Because XP2000 was planned to emphasize interior convenience, comfort and safety features and exterior architecture, no special engine was developed. A 5-liter V-8 is installed, which demonstrates the versatility of the architecture. However, Doble said the "conceptual" engine would be a V-8 of about 3.5 liters -- or, alternatively, a further advancement of the acclaimed 3800 V-6.

The front-mounted engine is combined with an advanced electronically controlled five-speed automatic transmission.

SPECIFIC FEATURES

Cindy McColley, Buick's manager of shows and exhibits, said the best way to understand the new concept car is to "take a look at XP2000 in our auto show display and imagine what it could do for you as a driver or passenger."

This new world unfolds as the driver approaches XP2000. In place of today's metal key is a tiny transmitter, much like today's remote keyless entry. Programmed for each individual driver, this keyless fob can, at the push of a button, unlock the vehicle and immediately adjust the seats, steering column, mirrors, climate control and entertainment system to settings chosen by that person.

Called Customer's Choice, this feature can even adjust the way the car drives, by tailoring the steering effort, suspension feel, engine response and transmission shift pattern to the tastes of the individual driver.

A security code in the keyless fob is recognized by the car's computers. When the fob is inserted into a slot in the instrument panel, and then gently pushed, the car will start.

Customers can also tailor XP2000 to their individual needs by inserting a GM "Smart Card" in another slot in the instrument panel. The Smart Card, essentially a flat plastic encapsulated memory chip, is both a credit card and a personal information card.

The Smart Card stores each driver's Customer's Choice settings, allowing them to be transferred to any Buick with this feature. It also allows the driver to automatically charge tolls, fuel, food and other services. The Smart Card even stores a wealth of personal information, from phone numbers to emergency medical data.

Once under way, the XP2000 provides the driver with a broad range of options.

Sensors under the car can link XP2000 to wire guidance systems planned for superhighways of the 21st Century. They would enable the driver to travel hands-off at speeds of 150 mph or more, and allow the

driver and passengers to use the extensive communications capabilities of the car for work or entertainment during commutes and long trips.

When the car is parked or in wire-guided mode, the instrument panel may be configured for a portable office or entertainment display, using an infrared remote link to a notebook computer or other communication device.

Even when driven manually, XP2000 uses technology to make driving safer and more enjoyable. A programmable color head-up display projects important information onto the lower windshield and into the driver's line of sight, eliminating the need to look away from the road while driving. The display, a refinement of today's first-generation head-up displays, is crisp and colorful, and can be configured to suit the preference of each driver.

The head-up display and instrument panel also show XP2000's advanced "Smart Arrow" navigation system, which provides driving routes to a chosen destination, and other information, in an easy-to-use form. A vehicle direction arrow shows the way on a map display, along with route names and distance-to-destination information.

Smart Arrow can show the colors of approaching traffic lights, and inform of approaching emergency vehicles. It can even be programmed to provide detailed, up-to-date information on restaurants, hotels and tourist attractions.

A Voice Command option allows many features of XP2000 to be operated in a totally hands-off manner. The car can be programmed by the driver to recognize his or her voice. Simple voice commands may then be used to operate the climate control, entertainment system, head-up display, Smart Arrow navigation system and Adaptive Cruise Control.

PRACTICAL COMFORT

Unusually roomy for a mid-size four-door, XP2000 is foremost a practical, comfortable family sedan.

The elegant yet practical shape of XP2000 provides a large greenhouse for upright seating and excellent visibility. An estimated drag co-efficient of 0.30 ensures economical highway cruising.

Fuel efficiency is further enhanced by advanced 18-inch Michelin tires, which provide Z-rated high-speed safety and fuel-saving low-rolling resistance.

Seating of XP2000, designed by Buick's Seat Comfort Team, provides the same acclaimed luxurious support as many of today's Buicks. As an added comfort feature, the rear seats have individual power-adjustable seat backs.

An enhanced lighting system makes getting in and out of the XP2000 easier and safer. As the driver approaches the car, the remote keyless transmitter sends a signal that turns on the headlamps, back-up lamps and interior lights, providing good visibility around the car.

Also part of the system are "puddle lights" under the rocker panels. These illuminate the area beneath the doors to reveal ice, water or other potential hazards.

Like some other comfort and convenience features of XP2000, this enhanced light system is a practical, customer-oriented use of technology, one that will provide enhanced value to Buick buyers in the near future.

ADVANCED SAFETY

Safety has become increasingly important to car owners. The XP2000 represents the logical evolution of today's safety systems.

Like many of today's Buicks, XP2000 is built around an advanced body structure, which helps absorb the energy of front, rear and side impacts while forming a protective cage around the passenger compartment.

Seat belts are integrated with the seat structures, so the belts are always positioned for maximum comfort and protection.

To further protect the occupants, XP2000 has eight air bags. The familiar air bags in the steering wheel and passenger side of the instrument panel are joined by air bags on the back of each front seat, which help protect rear seat passengers.

In addition, side impact protection is enhanced by air bags in the front and rear door panels.

As an added feature, the car's computers can be programmed to automatically place phone calls to local emergency services -- even to the driver's personal physician -- if there is an accident serious enough to activate the air bags.

A better idea than reacting to accidents, the XP2000 has a number of new technologies designed to make an accident less likely.

Adaptive Cruise Control calculates the distance to the vehicle in front of XP2000, and allows the driver to adjust the cruise control to automatically maintain a set, safe distance. The system will alert the driver if the vehicle ahead slows suddenly, allowing more time for a safe, controlled deceleration.

To make driving safer, XP2000's Near Obstacle Detection System automatically detects cars, pedestrians and objects moving into the path of the car, and flashes a warning on the head-up display.

Night driving safety is further enhanced by new-generation high intensity discharge headlamps, which make it easier to see road signs and hazards.

When XP2000 is placed in reverse, the Near Object Detection System scans for objects behind the vehicle. Both the head-up display and an audible signal warn the driver of any danger. Also, the outside mirrors rotate down automatically to improve rear visibility and help eliminate blind spots.

XP2000 also includes systems that greatly reduce the chance of highway breakdowns. Sensors throughout the vehicle monitor all critical functions, from the condition of the engine to the air pressure in the tires. If these sensors spot a problem, the car will alert the driver -- and can even be programmed to automatically notify the nationwide network of Buick Premium Roadside Assistance and dealership service departments.

These advanced self-diagnostics allow most malfunctions to be detected long before they affect the safety or driveability of the car, or lead to a breakdown that inconveniences the driver.

In some cases, the malfunction can be fixed by software adjustments automatically transmitted from a Buick dealership to the car. If more extensive service is required, the car can even be programmed to consult with the driver's personal computer and the nearest dealership, then schedule a service appointment.

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(GM)

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Oh, the humanity. (interactive service implementation and human factors)
(The Network) (Column)
Wilson, Carol
InterActive Week, v1, n2, p56(1)
Nov 7, 1994

TEXT:

The biggest challenge facing companies targeting interactive services for the American home isn't hardware, software or systems integration. It's human.

Every step -- building a broadband interactive network, developing services to ride on that network and getting people to use and pay for those services -- demands the development of significant new skills.

Unless companies succeed in human re-engineering, the most sophisticated networks carrying the most dynamic content won't succeed. Period.

Change is already afoot among telephone and cable companies. Telephone companies are trimming their ranks and requiring new skills from current and prospective employees. Cable companies are creating customer service organizations and building new systems.

Some of it's high profile, like Ameritech hiring an executive from Nickelodeon. But most of it is happening behind the scenes, within the bowels of company operations.

For example, telephone company employees are used to a hierarchical company structure. In the past, their jobs were divided by function: outside plant people worked on telephone poles and in manholes; central office workers stayed indoors and monitored equipment; customer service personnel worked in the business office and answered the phone.

In the old paradigm, when a customer reported a service outage the customer service representative initiated a trouble ticket. Depending on the level of automation, that ticket worked its way through the system until it reached a dispatch desk, where a technician would pick it up and try to solve the problem.

In formulating its broadband network plan, Pacific Bell is revamping a system that routed trouble tickets through six different organizations, says John T. Stankey, executive director, broadband process and systems engineering.

In its new network, now under construction, an interface device on the side of the customer's house will allow Pac Bell to immediately check the status of service and detect problems. The customer call never comes in -- the network detects the problem and either automatically solves it or alerts appropriate personnel.

So where does the talent come from to deal with customers in new ways?

"We see it as a significant problem -- the human re-engineering issues," says Stankey. "Significant human capital skill sets need to be developed and we will have to acquire and buy those skills."

Translation: What worked in the past won't work in the future. The telephone company must either hire a lot of new people or retrain the old ones.

Cable companies don't have it much better. They've been notorious for rotten customer service. That won't cut it in an increasingly competitive environment.

Service providers are not alone in facing serious human re-engineering issues. There's also a serious talent gap for content creators, says David Larson, director of digital media markets for the Visual Systems Group of Silicon Graphics.

Publishers, entertainment companies, game manufacturers and broadcasters are facing a talent void. "There are not enough quality-trained people to create good content," says Larson. "We need to retrain people."

Developing good content means completely restructuring the creative process. Content creators become the post-production people in an integrated process done on a computer terminal. Those creative types need

more technical skills, and the technical types need to be part of the creative process.

In the final stages of retraining, the entire industry is going to have to re-engineer its audience. Consumers are going to have to learn new ways of doing things to take advantage of these new services. But it's unclear whether the industry can turn couch potatoes into interactive TV watchers and catalog shoppers into surfers in a network mall.

Can the industry do it? This much seems clear: Those companies that do the best job of retraining their own people stand the best chance of retraining their customers. Let's see who's ready to step up to the challenge.

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